WHAT IS NEW AND DESIRED TO BE SECURED BY LETTERS PATENT OF THE UNITED STATES IS:

1. A plasma source assembly comprising:

an outer shield;

a dielectric chamber wall;

a helical coil provided between said outer shield and said dielectric chamber wall; and

a coil support means for facilitating repeatable performance of said helical coil.

2. The plasma source assembly according to Claim 1, wherein said outer shield comprises a plurality of plates.

3. The plasma source assembly according to Claim 1, further comprising means for tuning said helical coil to a predetermined frequency.

4. The plasma source assembly according to Claim 1, wherein said dielectric chamber wall and said outer shield define a resonator cavity, and wherein said helical coil is provided within said resonator cavity.

5. The plasma source assembly according to Claim 4, further comprising:

means for securing said helical coil within said resonator cavity; and

means for circulating cooling fluid throughout said resonator cavity.

6. The plasma source assembly according to Claim 4, further comprising a plenum cooling plate defining a manifold configured to supply cooling fluid to said resonator cavity.

7. The plasma source assembly according to Claim 6, further comprising means for removing bubbles from the cooling fluid, wherein:

said helical coil has an upper end affixed to said resonator cavity and open to a supply side of said plenum cooling plate; and

an upper part of said resonator cavity has a return opening configured to return the cooling fluid to a return chamber of said plenum cooling plate.

8. The plasma source assembly according to Claim 6, wherein said plenum cooling plate is configured to supply cooling fluid to a first cooling rod provided within said resonator cavity.

9. The plasma source assembly according to Claim 8, wherein:

said first cooling rod is provided radially outside said helical coil; and

said first cooling rod has at least one outlet hole configured to discharge the cooling fluid in a circumferential direction within said resonator cavity.

10. The plasma source assembly according to Claim 8, wherein said plenum cooling plate is configured to receive cooling fluid from a second cooling rod provided within said resonator cavity.

11. The plasma source assembly according to Claim 10, wherein:

said second cooling rod is provided radially inside said helical coil; and

said second cooling rod has at least one inlet hole configured to receive the cooling fluid from within said resonator cavity.

12. The plasma source assembly according to Claim 10, further comprising a spacer provided between said first cooling rod and said second cooling rod.

13. The plasma source assembly according to Claim 12, further comprising coil insulators abutting said spacer and provided between said first cooling rod and said second cooling rod, wherein said coil insulators have holes configured to receive said helical coil.

14. A plasma processing system comprising:

a process chamber;

a chuck assembly provided within said process chamber;

a gas inject assembly provided opposite said chuck assembly; and

a plasma source assembly comprising a dielectric chamber wall, a helical coil, and an outer shield mounting said gas inject assembly to said process chamber, said outer shield comprising a plurality of plates.

15. The plasma processing system according to Claim 14, further comprising at least one sealing member provided between adjacent plates of said plurality of plates.

16. The plasma processing system according to Claim 14, further comprising means for stacking and detachably joining said plurality of plates.

17. The plasma processing system according to Claim 14, further comprising:

said dielectric chamber wall and said plurality of plates defining a resonator cavity; and

a helical coil provided within said resonator cavity.

18. The plasma processing system according to Claim 14, further comprising means for tuning said helical coil to a predetermined frequency.

19. The plasma processing system according to Claim 17, further comprising:

means for circulating cooling fluid throughout the plasma processing system; and

a plenum cooling plate defining a manifold configured to supply cooling fluid to said means for circulating.

20. The plasma processing system according to Claim 19, wherein said gas inject assembly is provided between said dielectric chamber wall and said plenum cooling plate.

21. The plasma processing system according to Claim 19, further comprising means for removing bubbles from the cooling fluid.

22. The plasma processing system according to Claim 19, wherein said plenum cooling plate is configured to supply cooling fluid to a first cooling rod provided within said resonator cavity.

23. The plasma processing system according to Claim 22, wherein:

said first cooling rod is provided radially outside said helical coil; and

said first cooling rod has at least one outlet hole configured to discharge the cooling fluid in a circumferential direction within said resonator cavity.

24. The plasma processing system according to Claim 22, wherein:

said plenum cooling plate is configured to receive cooling fluid from a second cooling rod provided within said resonator cavity;

said second cooling rod is provided radially inside said helical coil; and

said second cooling rod has at least one inlet hole configured to receive the cooling fluid from within said resonator cavity.

25. The plasma processing system according to Claim 24, further comprising:

a spacer provided between said first cooling rod and said second cooling rod; and

coil insulators having holes configured to receive said helical coil.

26. A method of manufacturing a plasma processing system, said method comprising the steps of:

providing a process chamber;

providing a chuck assembly within the process chamber;

providing a gas inject assembly opposite the chuck assembly; and

mounting the gas inject assembly to the process chamber using an outer shield, the outer shield comprising a plurality of plates.

27. The method according to Claim 26, wherein the plurality of plates are stacked and detachably joined to one another, and further comprising the step of providing at least one sealing member between adjacent plates of the plurality of plates.

28. The method according to Claim 26, further comprising the steps of:

providing a dielectric chamber wall, wherein the dielectric chamber wall and the plurality of plates define a resonator cavity; and

providing a helical coil within the resonator cavity.

29. The method according to Claim 28, further comprising the step of tuning the helical coil to a predetermined frequency.

30. The method according to Claim 28, further comprising the steps of:

attaching a brass plug to the resonator cavity using a high temperature soldering process; and

attaching the brass plug to the helical coil using a low temperature soldering process.

31. The method according to Claim 28, further comprising the step of providing a plenum cooling plate defining a manifold configured to supply cooling fluid to the resonator cavity and the gas inject assembly.

32. The method according to Claim 31, further comprising the step of providing the gas inject assembly between the dielectric chamber wall and the plenum cooling plate.

33. The method according to Claim 31, further comprising the steps of:

providing a first cooling rod within the resonator cavity radially outside the helical coil;

supplying cooling fluid to the first cooling rod via the plenum cooling plate;

providing an outlet hole on the first cooling rod that is configured to discharge the cooling fluid in a circumferential direction within the resonator cavity;

providing a second cooling rod within the resonator cavity radially inside the helical coil; and

receiving cooling fluid in the plenum cooling plate via the second cooling rod.

34. A method of manufacturing a plasma source assembly, said method comprising the steps of:

providing an outer shield;

providing a dielectric chamber wall; and

mounting a helical coil between the outer shield and the dielectric chamber wall using a coil support means for facilitating repeatable performance of the helical coil.

35. The method according to Claim 34, further comprising the step of tuning the helical coil to a predetermined frequency.

36. The method according to Claim 34, wherein the dielectric chamber wall and the plurality of plates define a resonator cavity, and wherein the helical coil is provided within the resonator cavity, further comprising the step of securing the helical coil within the resonator cavity.

37. The method according to Claim 36, further comprising the step of supplying cooling fluid to the resonator cavity using a plenum cooling plate defining a manifold.

38. The method according to Claim 37, wherein:

the plenum cooling plate is configured to supply cooling fluid to a first cooling rod provided within the resonator cavity;

the first cooling rod is provided radially outside the helical coil; and

the first cooling rod has at least one outlet hole configured to discharge the cooling fluid in a circumferential direction within the resonator cavity.

39. The method according to Claim 38, wherein:

the plenum cooling plate is configured to receive cooling fluid from a second cooling rod provided within the resonator cavity;

the second cooling rod is provided radially inside the helical coil; and

the second cooling rod has at least one inlet hole configured to receive the cooling fluid from within the resonator cavity.

40. The method according to Claim 39, further comprising the steps of:

providing a spacer between the first cooling rod and the second cooling rod; and

providing coil insulators abutting the spacer and between the first cooling rod and the second cooling rod, wherein the coil insulators have holes configured to receive the helical coil.